Canada. Ripple Rock, Commission on

# REPORT ON THE REMOVAL
OF
# RIPPLE ROCK

(DEPARTMENT OF MARINE)

COMMISSIONERS:
MR. L. E. CÔTÉ (Chairman) DR. E. E. BRYDONE-JACK
MR. C. E. CARTWRIGHT

FEBRUARY 20, 1931

OTTAWA
F. A. ACLAND
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
1931

No. 66666
Ripple Rock,
W. 9.

# REPORT ON THE REMOVAL OF RIPPLE ROCK

To the Deputy Minister,
Department of Marine,
Ottawa, Ont.

## INSTRUCTIONS

SIR,—We beg to submit herewith, our report in reference to the removal of Ripple Rock, in Seymour Narrows, B.C., in accordance with instructions contained in the following telegram to Mr. L. E. Côté, Chairman of the Commission appointed by Order in Council, on December 13, 1930, to investigate conditions at the Second narrows of Burrard inlet, B.C.:

OTTAWA, ONT., January 23, 1931. 11.24 A.

L. E. CÔTÉ,
Vancouver Hotel,
Vancouver, B.C.

Request has been received from Joint Committee representing interests in Vancouver that scope of your commission should be extended to inquire into feasibility of removing Ripple rock Seymour narrows Stop You will therefore proceed to obtain the opinion of interested persons in Vancouver including Harbour Commission, Board of Trade, Merchants Exchange and Shipping Federation Stop You will also communicate with our agent Victoria so that he may arrange that you confer with interests at Victoria and ascertain their views respecting this matter if Public Works Engineer has not sufficient information available respecting Ripple rock may be necessary for commission to visit location but as little time as possible should be spent in carrying on inquiry.

(Signed) A. JOHNSTON.
9.10 A.

## LOCATION AND DESCRIPTION OF RIPPLE ROCK

The Ripple rock referred to in the above telegram, is located at the southern end of Seymour narrows. Seymour narrows is a narrow waterway about 2,400 feet wide between Vancouver island, on the west, and Quadra and Maud islands, on the east. Its location is shown on the chart, Appendix No. III, which accompanies this report. Seymour narrows is the only channel, on what is known as the inside passage between the gulf of Georgia and Queen Charlotte sound, which is available for vessels of any size engaged in regular traffic north and south. The following is a description of Ripple rock and the tidal currents in its vicinity, as contained in the "British Columbia Pilot, Volume I, 1923 Edition" (pages 269 to 271 inclusive):—

"Ripple Rock (Lat. 50° 08′ N., Long. 125° 21′ W.) a dangerous shoal with two heads lying north and south of each other, nearly one cable apart, the northern head with 1½ fathoms (2m7) least water being the shoalest, lies in the centre of the narrows. There is a depth of 4 fathoms (7m3) and on the southern head, from 22 to 40 fathoms (40m2 to 73m2) in the eastern channel, and from 37 to 66 fathoms (67m7 to 120m7) in the western one, both being about two cables wide. The position of the rock is indicated by the tide race and eddies over it, except for a short time at slack water.

"Tidal Streams. The streams run with great velocity, the flood or south going stream attaining a rate of 12 knots at some of the highest tides, and the ebb of 10 knots. The strength of the flood or south going stream is well maintained until near Race point, off which it sometimes runs 9 or 10 knots at springs, causing strong eddies southeast of Maud island and towards Menzies bay as before mentioned.

"The duration of slack water may amount to 12 minutes but at the highest tides it is a matter of a few minutes.

"During the strength of either stream the eddies in the narrows are very heavy, and every precaution must be taken by those navigating it with extra men at the helm.

"With fresh northerly or southerly winds the races and eddies become very dangerous for boats and small vessels.

"The times of slack water are given in the Canadian tide tables for the Pacific coast.

"Directions. Except to those with intimate local knowledge, it is recommended to enter the Narrows only at or near slack water, and to keep the eastern shore aboard to avoid Ripple rock, remembering, if going north with a favourable or ebb stream, that the stream sets obliquely over towards the rock as Maud island is rounded.

"Duncan and Menzies bay on the south, and Plumper bay close to on the north are convenient anchorages while waiting for slack water.

"The following directions are given by Lieutenant Commander B. L. Johnson, R.N.R., of the Vancouver Pilotage Service, who has navigated various classes of coasting vessels through these narrows:—

## "DURING THE EBB

"North bound. Pass Race point at a distance of one cable, heading directly for broken water on Ripple rock. Pass Maud Island Lighthouse point at a distance of about 300 feet, or just outside the swirl off the point, steering for northern edge of broken water from Ripple rock; then with this swirl abaft the beam, port easy until in mid-channel off North bluff, the southern entrance point of Plumper bay. (Lat. 50 deg. 08′ N., Long. 125 deg. 21′ W.)

"Warning. If Maud Island Lighthouse point is given a wide berth and a course is set to clear Ripple rock, the current is on the starboard quarter, and the ship is set towards the rock, and when porting helm to avoid this, there is danger of being forced into the eddy.

"The narrows can be safely run, north bound, at any stage of the ebb, by a handy ship if fitted with good steering gear. The broken water over Ripple rock can be plainly seen even on the darkest nights when the current has any strength.

"South bound. This is the most awkward passage to make through Seymour narrows and should not be attempted except at first and last hours of ebb, and then only by handy ships with at least thirteen knots speed. On big tides, that is, tides with more than thirteen feet range at Port Simpson, a speed of sixteen knots and a vessel particularly quick to answer her helm is necessary for the safe passage during the second and third hours of ebb.

"Directions. Keep mid-channel until North bluff is abeam and then head for westerly extreme of Maud island, keeping on edge of eddy. As Canoe pass (north side of Maud island) opens, be lively with starboard helm. Meet the current fair end on, as Canoe pass closes. After passing Ripple rock, do not hug Maud island too close as there is an inset between the eddy and the main current a short distance northwest from Lighthouse point. The strongest current is off this point and the over-fall can be clearly distinguished during the second, third and fourth hours of ebb.

"Strangers finding the ebb running are advised to navigate at slack water only. The passages should be used with caution at night with any strength of current, even by those having intimate local knowledge.

## "DURING THE FLOOD

"North bound. After passing Copper cliffs, keep to starboard of mid-channel to avoid heavy swirls off Race point; round this point at a distance of two cables and head for north point of Menzies bay, with ship's head about W. by S. magnetic. As the channel opens, swing easy until ship is heading up mid-channel between Maud island and Ripple rock. Avoid being set towards Maud island. When Lighthouse point is abaft the beam, the starboard shore may be favoured, as the current here is quite straight. When Canoe pass opens, work into mid-channel to avoid eddying and broken water off North bluff. (Lat. 50 deg. 08′ N., Long. 125 deg. 21′ W.)

"The strongest current is off the extreme west point of Maud island. The over-fall here is quite distinct. A thirteen knot vessel may work up as far as Ripple rock on any tide, but a speed of at least seventeen knots is required to drive through at full strength of spring tides. It is advisable to make the turn, so as to be stemming the current when passing Lighthouse point, where the straight current has least width. The passage through Seymour narrows against the flood is safe and easy if a vessel has sufficient power.

"South bound. Keep mid-channel until North bluff is abeam, then head between Ripple rock and Maud island, keeping this general southeast course until Gowlland harbour is closing with Race point; then starboard to about E. by N., keeping this general course until Cape Mudge light is well open off Orange point, then swing easy and favour port shore to obtain full benefit of fair current.

"The line of straight current during the flood can be clearly distinguished on a calm night."

Quadra island, to the north, and Maud island, to the south, are located on the east side of Seymour narrows. Between Quadra island and Maud island is a small channel known as Canoe pass.

## HEARINGS

Public hearings were held in both Vancouver and Victoria.

### Vancouver Hearings

The public hearings in Vancouver were held on January 28 and 29. The following is a list of those giving evidence or making representations at the Vancouver hearings:—

Captain Wearmouth, B.C. Pilots.
Captain Smith, B.C. Pilots.
Captain Moorehouse, B.C. Pilots.
Captain McMurray, Canadian Pacific Steamship Coast Service.
Captain Slater, Canadian Pacific Steamship Coast Service.
Captain Elliott, Coastwise Steamship & Barge Company.
Captain Donald, Canadian National Steamship Company.
Captain Edgecombe, Canadian National Steamship Company.
Captain Gilbert, Canadian National Steamship Company.
Commander Nicholls, Canadian National Steamship Company.
Mr. J. Hamilton, Secretary Vancouver Merchants' Exchange, also Secretary of Special Committee composed of members of the Vancouver Merchants' Exchange and Vancouver Board of Trade.
Commander B. L. Johnson, Lloyds Agent.
Mr. H. D. Parizeau, Canadian Hydrographic Service.
Captain Saunders, Supt. Pilots, Vancouver.
Captain A. Johnston, Union Steamship Company.
Captain Tracey, Alaska Steamship Company.
Captain Anderson, Alaska Steamship Company.
Captain Westerlund, Alaska Steamship Company.
Mr. Gilkey, Puget Sound & Barge Company, Seattle.
Mr. Carl Strout, Pacific Steamship Company, Seattle.
Captain Graham, Pacific Steamship Company, Seattle.
Captain Knight, Pacific American Fisheries.
Captain Jones, Standard Oil Company.
Captain Caga, Standard Oil Company.
Mr. Garfield, Seattle Chamber of Commerce.

### Victoria Hearings

The public hearings in Victoria were held on January 30, January 31 and February 2. The following is a list of those giving evidence or making representations at the Victoria hearings:—

Alderman W. T. Straith, representing City Council of Victoria, B.C.
Captain Wm. Cotsford (retired).
Captain T. Cliff.
Captain John Bell Irving (retired).
Captain E. W. Graves, Canadian National Steamship Co.
Captain C. Sainty, Canadian National Steamship Co.
Captain C. D. Neroutsos, Canadian Pacific Coastwise Service.
Captain McGraw, member of the Canadian Merchants Service Guild.
Mr. M. Jack, representing Navigating Officers on the Coast.

Mr. A. Norstrom, representing Northern Dredging Company.
Mr. H. D. Parizeau, of the Hydrographic Department.
Mr. W. E. Losee, Mechanical Engineer.
Mr. Dennis Harris, formerly engineer Canadian Pacific Railway Company.
Mr. R. P. Bishop, Land Surveyor.
Mr. R. T. Williams, Mr. C. L. Harrison, Mrs. Alice McGregor—representing a public meeting held in Victoria, B.C.
Mr. W. R. Mitchell, representing a public meeting held in Nanaimo, B.C.
Mr. O. H. Brown.
Mr. Alex. Watson.
Mr. T. Thompson.
Mr. John Dean.

## SUMMARY OF REPRESENTATIONS MADE AT THE VANCOUVER AND VICTORIA HEARINGS

All the evidence heard in Vancouver was in favour of the removal of Ripple rock. Witnesses were presented to the commission by Mr. J. H. Hamilton, Secretary of the Joint Committee of the Vancouver Merchants' Exchange and of the Vancouver Board of Trade.

Mr. Hamilton presented to the commission a copy of a Report of a Joint Committee of the Vancouver Merchants' Exchange and of the Vancouver Board of Trade, dated January 25, 1928. A letter transmitting a copy of this report to the commission, dated January 27, 1931, endorses the 1928 report but eliminates the suggestion of damming the Canoe pass between Quadra and Maud islands, and also eliminates the suggestion for the establishment of marks on the Vancouver island shore, preferring that any recommendation of this nature should be developed during the course of the inquiry. The report of 1928, with these omissions, is a plea for the removal of Ripple rock to provide a minimum depth of four fathoms, 24 feet, at an estimated cost of $350,000 as a maximum. This report is given on pages 3 to 12 inclusive, of the transcript of evidence, Vancouver, B.C., Appendix No. I.

Mr. Hamilton also presented as witnesses before the commission, representatives from the Seattle Chamber of Commerce and from the American Shipping Companies, whose ships pass through Seymour narrows. The brief presented by the Seattle Chamber of Commerce is given on pages 12 to 14 of the transcript of evidence, Appendix No. I.

The evidence heard in Victoria was divergent and conflicting, the shipping interests and masters and pilots pressing for the removal of the rock, and a committee (appointed at a public meeting held in Victoria) and others pressing for the retention of the rock, in its present state, while the councils of the cities of Victoria and Nanaimo were neutral.

At the opening of the hearings in Victoria, Alderman Straith, on behalf of Mayor Anscombe, announced that the Council of the City of Victoria took no part either for or against the removal of Ripple rock. See pages 2 and 3, transcript of evidence at Victoria, Appendix No. II.

The Council of the City of Nanaimo also had no expression of opinion to offer but the following resolution, passed at a citizens' meeting in Nanaimo, was submitted by Mr. W. R. Mitchell:—

January 29, 1931.

Moved by Arthur Leighton, seconded by George S. Pearson, M.P.P.: Be it hereby resolved that we, the citizens of Nanaimo, in public body assembled for the purpose of considering the advisability for the removal or otherwise of Ripple Rock, Seymour narrows, are of the opinion that laymen have a very superficial knowledge of the question, and being a marine subject, should be dealt with by experts in marine matters; but if after

investigation it is found that the rock is a menace to navigation, it should then be removed, but removed in such a manner as not to destroy the possibility of the base for a bridge pier, should the wisdom of a bridge at this point be shown to be necessary in the future.
See page 22, transcript of evidence, Appendix No. II.

## EVIDENCE IN FAVOUR OF THE REMOVAL OF RIPPLE ROCK

The evidence given, both in Vancouver and in Victoria, by masters of ships, pilots and all shipping interests, was unanimous, consistent and emphatic, as to Ripple rock being a very serious danger to navigation, and that the construction of a pier on Ripple rock would greatly increase this danger, even if light and fog signals were established thereon. Their difficulty in navigation is due, in a great extent, to the necessity of using the eastern channel between Ripple rock and Maud island, and to the difficulty of avoiding back eddies or being driven by currents against Ripple rock. This difficulty is greatly increased if two or more ships meet in the channel. As there is a sharp bend in the channel around the south end of Maud island, the difficulty is still further increased.

## EVIDENCE IN OPPOSITION TO THE REMOVAL OF RIPPLE ROCK

The opposition to the removal of Ripple rock came, very largely, from a committee, consisting of Mr. C. L. Harrison, Mrs. Alice McGregor and Mr. R. T. Williams, appointed at a meeting held in Victoria on January 29.

It appears from the evidence that the opposition to the removal of Ripple rock is based on the desire of those represented by this committee, that Vancouver island should have highway, or both highway and railway connection with the mainland of British Columbia. They consider that Ripple rock should be left in its present state for the purpose of placing a pier on the rock as a support for a bridge over Seymour Narrows at that point. They state that a highway is being built north from Campbell river to Menzies bay and Sayward, and that with a bridge over Seymour narrows, direct highway communication could be provided from Seymour narrows to the headwaters of Bute inlet and thence up the Homathko river to Tatla lake in the Chilcotin, joining there with the present road system of the interior of British Columbia. See map attached, Appendix No. IV.

The commission feels that the feasibility or otherwise, of such a highway, is not a question on which they should express any opinion, as they do not regard the retention of Ripple rock in its present form, to be necessary for a connecting link to Vancouver island, for the following reasons:—

(1) From the formation and outline of Ripple rock as given by soundings, we consider that it would be necessary to level off the top of this rock to a depth greater than that required to safeguard navigation, before any pier could be located on the rock. Removal of this rock to a depth of 30 feet for navigation purposes, would then be a help rather than a hindrance if a pier were considered either feasible or desirable.

(2) If at any time a highway from Bute inlet or Seymour narrows is constructed to the interior of British Columbia, which would prove a very costly work with many large bridges and heavy rock work, connection could be made

(*a*) by a suspension bridge with a single span across Seymour narrows; or
(*b*) by a ferry service either from the head of Bute inlet or across Discovery passage just north of Seymour narrows.

See evidence of Captain Bishop, pages 96 to 100, transcript of evidence, Appendix No. II.

Extensive surveys would have to be made to determine the best location for any bridge over Seymour narrows, but the shortest single span could be obtained at some point from one-half to one mile north of Ripple rock.

Provided the approaches were found suitable, it is quite possible that a single span of 2,200 or 2,300 feet at this point would prove cheaper as well as afford better approaches than a two-span structure with a pier on Ripple rock. Owing to the extremely strong currents, swirls and eddies around Ripple rock at various stages of the tide, the construction of a pier on Ripple rock would prove an extremely hazardous and expensive undertaking even if it were feasible, while the tower would be extremely high and require a wide base.

In this connection, attention may be called to the memorandum in reference to costs submitted by Mr. W. E. Losee, a well known contractor of Victoria. See Schedule "C," transcript of Victoria evidence, Appendix No. II.

All mariners, however, were extremely strong in their condemnation of any attempt to put a pier on Ripple rock, stating that the danger to navigation would be greatly enhanced thereby.

## CLOSING CANOE PASS

Evidence submitted as to the desirability of closing Canoe pass between Maud and Quadra islands was conflicting and contradictory, both by mariners and engineers. This is because there is not sufficient data (owing to lack of knowledge of the variations in velocities and directions of the currents and eddies) on which to base any intelligent decison.

## DATA SUPPLIED TO THE COMMISSION

In addition to the general information given at the public hearings, we have received very valuable information, data and plans from Mr. H. D. Parizeau, Officer in Charge, Canadian Hydrographic Service, and Mr. C. C. Worsfold, District Engineer of New Westminster, B.C.

Mr. Parizeau made a survey of Ripple rock and took soundings in 1921. His survey disclosed the fact that another reef exists about 500 feet south of what is known as Ripple rock. This reef has an elevation of approximately 27 feet below low water. For convenience we may refer to this rock as Ripple rock No. 2. The main Ripple rock (Ripple rock No. 1) has an elevation of about 10 feet below low water. Attached is a blue print of a plan made by Mr. Parizeau showing location and soundings over these rocks. See Appendix No. V.

## INSTRUCTIONS ISSUED BY THE CHIEF ENGINEER OF THE DEPARTMENT OF PUBLIC WORKS

An investigation was made in April and May, 1928, to determine by what means Ripple rock could be removed at a cost which would not be prohibitive. This investigation was made under the direction of Mr. C. C. Worsfold, District Engineer, Public Works of Canada, assisted by Mr. W. A. Gourlay, Senior Assistant Engineer. Their report to the Chief Engineer of the Department of Public Works (attached in Appendix No. V (*f*) ) goes very fully into the various methods of removing the main Ripple rock. As a result of actual tests, made on site, they considered that the rock could be most readily removed by drilling from floating equipment. They based their estimate of cost on the removal of Ripple rock No. 1 to a depth of 27 feet below low water.

From the soundings taken by Mr. Parizeau, a model of Ripple rock No. 1 was constructed in Mr. Worsfold's office. This gives some idea of the formation of the rock and the location of peaks and hollows, etc. Attached to Appendix No. V (*d*) are photographs of this model.

On May 27, 1930, Mr. Worsfold reported to the Chief Engineer of the Department of Public Works, concerning the closing of Canoe pass between Maud and Quadra islands. A copy of this report is attached as Appendix No. V (*g*).

## CONCLUSIONS OF COMMISSION

### Removal of Ripple Rock

From the evidence submitted and from the data placed at its disposal, the commission has come to the following conclusions:—

(1) That it is desirable in the interests of safe navigation to remove the top of Ripple rocks Nos. 1 and 2, to a depth of at least 30 feet below low water and allow the full use of the channel. While it is felt that the removal of the rocks to this depth will not very materially alter the strength of the currents and eddies, it is felt that the principal danger existing in Seymour narrows is that of hitting Ripple rock.

Removal of the tops of the Ripple rocks to a depth of 30 feet below low water means that drilling and blasting must be done to a depth of at least 32 feet, so that a clear depth of 30 feet may be obtained. This involves the removal of about 4,000 cubic yards as against about 2,300 cubic yards if the top is removed to a depth of 27 feet below low water. The cost of removal, however, does not depend as much upon the yardage involved as upon the preparation and necessary special equipment for removal of any yardage. It is estimated that Ripple rocks Nos. 1 and 2 could be removed to a depth of 30 feet below low water at a cost of from $200,000 to $225,000.

The justification of this expenditure may be judged by the amount and value of the traffic passing through Seymour narrows as well as by the casualties and monetary losses caused directly or indirectly by Ripple rock.

Partial statistics of the number of ships using Seymour narrows together with their value, draught, number of trips, number of passengers, tonnage and value of cargo, has been furnished by Mr. J. H. Hamilton, Secretary of the Joint Committee of the Vancouver Board of Trade and the Vancouver Merchants' Exchange.

These statistics will be found in Appendix No. VI (*a*). They embrace eight (8) of the major United States companies and four (4) of the major Canadian companies operating on regular service through Seymour narrows.

These statistics do not take into consideration the towboat and fishing vessels and various other small craft passing through Seymour narrows.

In Appendix No. VI (*a*) will also be found statistics relating to United States trade and traffic passing through Seymour narrows as compiled from United States Government reports and business records for the year 1930.

From the data supplied by the United States Government reports and the partial statistics of Canadian business, it is roughly estimated that—

(1) Approximately from 1,500 to 2,000 passages per year are made through Seymour narrows by the larger passenger, freight and tramp vessels, while it may reach 6,000 to 7,000 trips for all vessels.

(2) That the value of these vessels exceeds $25,000,000.

(3) That the number of passengers carried through the Seymour narrows exceeds 175,000 per year, not including the crews of vessels.

(4) That the cargo tonnage exceeds 1,500,000 tons.

(5) That the cargo value exceeds $107,000,000.
Traffic through Seymour narrows has increased rapidly in the past few years and will increase rapidly in years to come, thereby increasing the danger at this point.

Casualties brought to the attention of the commission are listed in Appendix No. VI (*d*). Full information cannot be obtained as to the actual amount of loss in each case, but from figures on hand, an estimate of at least $200,000 in the past twenty years would be very conservative, and does not include the total loss of the U.S.A. man of war ss. *Saranac* or the U.S.A. ss. *Wachusett*.

It is difficult to approximate any figure for losses due to lost time at Seymour narrows. It is apparent from the evidence given before the commission that there is a real loss on this account as the masters of many of the vessels using Seymour narrows are instructed to go through at slack water only.

Considering these items, it is evident that the saving effected by the removal of Ripple rock will more than pay the interest on the cost of removal, even if the ever present possibility of a major accident involving great loss in human life is not considered.

### CANOE PASS

(2) We do not consider that we have sufficient data on hand to judge whether the closing of Canoe pass would be an advantage or a detriment to navigation, and we consider that the question of closing Canoe pass should be deferred until such time as more data are collected, and until after Ripple rock is removed. Some witnesses claimed that the volume of water coming through Canoe pass during ebb tide broke up the back eddy existing along the eastern shore of the narrows, and prevented it from extending south towards the lighthouse on Maud island, and that if Canoe pass were blocked, this eddy would extend further south and force vessels closer to Ripple rock. Others claimed that the volume of water from Canoe pass forces the eddy further out into midstream and so narrows up the channel that could be used by steamers; and that if Canoe pass were closed the eddy would not extend as far into the main channel.

The commission expressly wish to acknowledge the help and assistance given to them by Messrs. Parizeau and Worsfold, and their indebtedness for the data which they supplied.

Respectfully submitted,

LOUIS E. CÔTÉ,
*Chairman.*

E. E. BRYDONE JACK,
*Commissioner.*

C. E. CARTWRIGHT,
*Commissioner.*

VANCOUVER, B.C., February 20, 1931.

The following is a list of appendices attached to the report:—

APPENDIX I

Transcript of evidence—Vancouver.

APPENDIX II

Transcript of evidence—Victoria.

APPENDIX III

Admiralty Chart of Discovery passage and Seymour narrows. No. 3162.

APPENDIX IV

- (*a*) Map of Vancouver island, British Columbia, showing connection from Seymour narrows to the head of Bute inlet and Tatla lake in the interior of British Columbia (marked with a black line).
- (*b*) Photostat No. 5015 from the Department of Lands of Map A attached to the report of Alfred Waddington, dated January 31, 1863, submitted by Captain Bishop of Victoria.
- (*c*) Map submitted by Captain Bishop, Victoria, showing the highway to the head of Bute inlet; also photographs.

APPENDIX V

- (*a*) White print showing soundings at Ripple rock reef by Mr. H. D. Parizeau, 1921.
- (*b*) Print showing contours Ripple rock No. 1.
- (*c*) Print showing contours Ripple rock No. 2.
- (*d*) Photograph model of Ripple rock No. 1 made in Mr. Worsfold's office.
- (*e*) Various photographs submitted.
- (*f*) Cost of removal of Ripple rock submitted by Messrs. Worsfold & Gourlay to the Chief Engineer of the Department of Public Works in April and May, 1928.
- (*g*) Copy of report on the closing of Canoe channel submitted by Mr. C. C. Worsfold to the Chief Engineer of the Department of Public Works on May 27, 1930.

APPENDIX VI

Various letters and memorandum in addition to that given in transcript of evidence.

- (*a*) Statistics *re* traffic through Seymour narrows submitted by Mr. J. H. Hamilton.
- (*b*) Memorandum *re* bridging Seymour narrows submitted by Mr. W. E. Losee.
- (*c*) Notes on the historical aspect of rail and road communication between Vancouver island and the mainland, submitted by Captain R. P. Bishop, B.C.L.S.
- (*d*) Memo *re* casualties at Ripple rock submitted by Mr. W. J. Boyd.
- (*e*) Communications from Mr. Fred Larson,
  "　　"　Mr. G. T. Devereux,
  "　　"　Mr. Robert Sutcliffe.

NOTE.—The above are appended to original report only.